

Applicant : Christian Boettcher  
Serial No. : 10/722,362  
Filed : November 26, 2003  
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Attorney's Docket No.: 15540-017001 / 25897;  
Trumpf: 18.00246; DS07961

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently amended) A deformable mirror comprising:  
a reflecting surface disposed on a diaphragm;  
a diaphragm carrier that supports the diaphragm, wherein the diaphragm carrier defines a non-circular, pressurizable rear surface of the diaphragm, wherein the rear surface is an approximately rectangular surface, an approximately oval surface, or an approximately elliptical surface.
2. (Original) The deformable mirror of claim 1, wherein the rear surface is an approximately rectangular surface.
3. (Original) The deformable mirror of claim 1, wherein the rear surface is an approximately oval surface.
4. (Original) The deformable mirror of claim 1, wherein the rear surface is an approximately elliptical surface.
5. (Original) The deformable mirror of claim 1, wherein the diaphragm carrier comprises a lateral recess substantially parallel to the reflecting surface and adjacent to the rear surface of the diaphragm.
6. (Original) The deformable mirror of claim 1, further comprising a cooling fluid in contact with the rear surface of the diaphragm.

7. (Original) The deformable mirror of claim 6, wherein a pressure of the cooling fluid is different from a pressure on the reflecting surface, such that the shape of the reflecting surface is deformed.
8. (Original) The deformable mirror of claim 1, further comprising an actuator for pressurizing the rear side of the diaphragm.
9. (Original) The deformable mirror of claim 1, wherein the diaphragm carrier comprises a pipe socket with circular outer cross-section.
10. (Currently amended) A method of reflecting a laser beam, the method comprising:  
    directing the laser beam onto a deformable, reflecting surface, supported by a pressurizable diaphragm; and  
    altering a pressure within a diaphragm carrier that supports the diaphragm to deform the shape of the diaphragm and the reflecting surface, wherein the diaphragm carrier defines a non-circular pressurizable, rear surface of the diaphragm and wherein the rear surface is an approximately rectangular surface, an approximately oval surface, or an approximately elliptical surface.
11. (Original) The method of claim 10, wherein the rear surface is an approximately rectangular surface.
12. (Original) The method of claim 10, wherein the rear surface is an approximately oval surface.
13. (Original) The method of claim 10, wherein the rear surface is an approximately elliptical surface.
14. (Original) The method of claim 13, further comprising providing a cooling fluid in contact with the rear surface of the diaphragm.

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15. (Original) The method of claim 14, further comprising altering a pressure of the cooling fluid.
16. (Original) The method of claim 10, further comprising actuating an actuator to apply pressure to the rear surface of the diaphragm.
17. (Original) The method of claim 10, wherein the diaphragm carrier is a pipe socket with circular outer cross-section.

REMARKS

Claims 1-17 are pending in this application, with claims 1 and 10 being independent. Claims 1 and 10 have been amended. No new matter has been added. In particular, support for amended claims 1 and 10 is found in the application at claims 2-4 and 11-13.

35 U.S.C. § 102 Rejection

Claims 1, 5, 8-10, 16, and 17 have been rejected as allegedly anticipated by U.S. Patent No. 6,425,671 (“Adler”). Applicant requests withdrawal of this rejection and allowance of the claims because Adler does not disclose the subject matter of amended independent claim 1 or 10.

Amended claim 1 recites a deformable mirror including a reflecting surface disposed on a diaphragm and a diaphragm carrier that supports the diaphragm. The diaphragm carrier defines a non-circular, pressurizable rear surface of the diaphragm, and the rear surface is an approximately rectangular surface, an approximately oval surface, or an approximately elliptical surface.

Amended claim 10 recites a method of reflecting a laser beam including directing the laser beam onto a deformable, reflecting surface that is supported by a pressurizable diaphragm and altering a pressure within a diaphragm carrier that defines a non-circular pressurizable, rear surface of the diaphragm, where the rear surface is an approximately rectangular surface, an approximately oval surface, or an approximately elliptical surface.

Adler relates to a flexible mirror structure and assembly. See Abstract. A puller is attached to a rear surface of the mirror and can be tensioned to deform the mirror. See col. 1:53 – col. 2:35. As shown in FIG. 4, the puller is symmetric about a central axis, such that when tension is applied to the mirror with the puller, the mirror is deformed into a shape that is symmetric about a central axis. In particular, Adler states, “[t]he present inventors have discovered new methods of flexing spherical mirrors to achieve highly accurate axisymmetric shapes such as paraboloids. These methods involve one or more of the following: a. Pulling on a large diameter circular area of the mirror back. . . .” Col. 1:23-29 (emphasis added).

In contrast, claim 1 requires a non-circular, pressurizable rear surface of the diaphragm, where the rear surface is an approximately rectangular surface, an approximately oval surface, or an approximately elliptical surface. Similarly, claim 10 requires altering a pressure within a diaphragm carrier that supports the diaphragm to deform the reflecting surface. The diaphragm carrier defines a non-circular pressurizable, rear surface of the diaphragm, wherein the rear surface is an approximately rectangular surface, an approximately oval surface, or an approximately elliptical surface.

Because the shape rear surface of the diaphragm that applies pressure to the mirror is non-spherical (e.g., rectangular, oval, or elliptical), the mirror is deformed by different amounts in perpendicular directions (i.e., along and perpendicular to the long axis of the rectangle, oval, or ellipse), such that the mirror has different focal lengths along the perpendicular directions. As explained in the application, a mirror that can be deformed in a non-spherical shape is particularly useful when the mirror is used to deflect a beam through a relatively large angle because such a mirror does not introduce substantial astigmatism in the reflected beam. See page 4, lines 24-28; page 5, lines 15-18; page 5, lines 26-28. In contrast, mirrors having circular reflecting surfaces, when used to reflect a beam through a large angle require an additional reflecting surface to correct the astigmatism introduced by the circular mirror. See page 2, lines 1-6 and FIG. 5.

For at least these reasons, applicant requests withdrawal of the rejection and allowance of the claims.

#### 35 U.S.C. § 103 Rejections

Claims 2-4 and 11-13 have been rejected as allegedly obvious over Adler alone, citing In re Dailey, 357 F.2d 669 (CCPA 1966). Applicant respectfully submits that a prima facie case of obviousness has not been established and that the holding of Dailey is distinguishable from, and inapplicable to, the patentability of claims 2-4 and 11-13.

Claims 2-4 and 11-13 depend from claims 1 and 10, respectively, and require that the rear surface of the diaphragm has an approximately rectangular, oval, or elliptical surface,

respectively. Such shapes of the rear surface have a significant effect on the profile of a light beam reflected from the mirror. In contrast, the particular configuration of the invention for which a patent was sought in Dailey was not significant to the function of the invention.

In Dailey, the applicants sought a patent for a disposable plastic infant nursing container. One claim of the application recited that the container included top and bottom sections in a configuration of “a portion of a sphere less than a hemisphere.” Id. at 670. The board upheld the examiner’s rejection of this claim as unpatentable over a reference showing a container having top and bottom sections configured as connected hemispheres because the “the configuration of the container is a ‘mere matter of choice’ not significantly novel over [the cited reference].” Id. at 672. The CCPA affirmed the board’s decision because the applicants “presented no argument that convinces us that the particular configuration of their container is significant or is anything more than one of numerous configurations a person of ordinary skill in the art would find obvious for providing mating surfaces in the collapsed container of [the cited reference].” Id. 672-73.

Here, in contrast, when the rear surface of the diaphragm is pressurized the approximately rectangular, elliptical, and oval shapes for the rear surface of the diaphragm provide configurations of the diaphragm that cause the mirror to be deformed into non-spherical shapes that are not symmetric about a central axis of the mirror. Such shapes cause the deformed mirror surface to reflect a light beam at a high angle without introducing an astigmatism in the reflected beam. Thus, the shape of the rear surfaces has a significant effect on the function of the mirror and the resulting beam reflected from the mirror. A change in shape from the axially-symmetric shape disclosed in Adler would not have been obvious, because such a change of shape would have introduced an astigmatism in on-axis reflections for which Adler’s mirror was intended.

For at least these reasons and because claims 2-4 and 11-13 depend from independent claims 1 and 10, which are allowable, applicant requests withdrawal of this rejection and allowance of the claims.

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Claims 6, 7, 14, and 15 have been rejected as allegedly obvious over Adler in view of U.S. Patent No. 5,020,894 ("Giesen"). Applicant requests withdrawal of this rejection and allowance of the claims because Giesen does not cure the deficiencies of Adler.

Giesen relates to a deformable mirror used to reflect a high power laser beam. However, Giesen does not disclose a non-circular, pressurizable rear surface of the diaphragm, when the rear surface in an approximately rectangular surface, and approximately oval surface, or an approximately elliptical surface. For at least this reason, Giesen does not cure the defects of Adler with respect to claims 1 and 10, and claims 1 and 10 are allowable.

Because claims 6 and 7 depend from claim 1 and claims 14 and 15 depend from claim 10, applicant requests withdrawal of this rejection and allowance of the claims.

### Conclusion

For the foregoing reasons, applicant requests allowance of all claims.

No fees are believed to be due at this time. Please apply any other charges or credits to deposit account 06-1050, referencing Attorney Docket No. 15540-017001.

Respectfully submitted,

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Mark R.W. Bellermann  
Reg. No. 47,419

Fish & Richardson P.C.  
1425 K Street, N.W.  
11th Floor  
Washington, DC 20005-3500  
Telephone: (202) 783-5070  
Facsimile: (202) 783-2331